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ILLINOIAN AND KANSAN MOLLUSCAN FAUNAS OF ILLINOIS

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ILLINOIAN AND KANSAN MOLLUSCAN FAUNAS OF ILLINOIS

A. Byron Leonard, John C. Frye
and W. Hilton Johnson

ABSTRACT

Molluscan faunas of Kansan and Illinoian age collected from 28 localities in Illinois are listed by geographic location and stratigraphic position. Eight of the faunas are of Kansan age, eleven are assigned to the Liman Substage of the Illinoian Stage, and ten are assigned to the Jubileean and Monican Substages of the Illinoian Stage. These faunas are composed predominantly of terrestrial forms, even though they occur largely in water-laid sediments, and they indicate an environment of forest-border, or mixed savanna and woodlands. Pleistocene molluscan faunas in Illinois are of minor value for stratigraphic correlation because of their essential similarity through the Quaternary. This history of faunal stability contrasts sharply with data from the Great Plains, where marked compositional changes in faunas, resulting from ecologic changes, have occurred during Pleistocene time.

INTRODUCTION

Within Illinois there is a nearly complete sequence of Pleistocene glacial and interglacial deposits, and, with the exception of the Nebraskan, or oldest, stage, all of the glacial stages and substages are known to have molluscan faunas. The faunas of the Wisconsinan Stage were reported by Leonard and Frye in 1960, and it is the purpose of this report to describe the molluscan faunas of the Illinoian and Kansan Stages.

During the past decade collections of fossil molluscan faunas have been made from pre-Wisconsinan deposits in Illinois by the three of us and by H. B. Willman. Reported here are 29 local faunal assemblages, 21 from deposits of Illinoian age and 8 from deposits of Kansan age. The fauna localities are distributed widely over the state as shown by the map of localities in figure 1, and, although not large in number the faunas are thought to be representative of the fossil mollusks of the Illinoian and Kansan Stages as they occur in the Illinois region.

STRATIGRAPHY OF FOSSILIFEROUS UNITS

The stratigraphy of the Pleistocene deposits of Illinois has recently been described and extensively reclassified by Willman and Frye (1970), and the stratigraphic terminology used in this report is in accord with their reclassification. Stratigraphic names used here are shown in figure 2. Because of the recency of this more detailed stratigraphic report, the stratigraphy of the deposits is not re-described in detail here. Rather, the molluscan faunas are placed briefly in their proper stratigraphic setting, and the reader is referred to the previously published reports for more detailed descriptions of units. The discussion of the stratigraphy and faunas is arranged by time-stratigraphic unit, but the faunas are related to the rock-stratigraphic unit in which they occur. Seven described stratigraphic sections (including eight faunal localities) are included with this report, and described stratigraphic sections for 14 additional faunal localities have been published previously and are cited in the locality list accompanying figure 3. Fossil shells were collected from silt, silt and sand, or clayey silt and occurred in eight rock-stratigraphic units.

Kansan Stage

The fossiliferous deposits of the Kansan Stage in Illinois are all included within the Banner Formation (Willman and Frye, 1970). The Banner Formation consists of glacial tills and intercalated outwash of sand and gravel and silt. At the base there occurs a proglacial silt unit classed as the Harkness Silt Member, and at the top occurs the silty clay and accretion deposits of the Lierle Clay Member. Further subdivision of the Banner has been undertaken only in part of eastern Illinois, where four till members and one fossiliferous silt, the Belgium Member, have been defined (fig. 2) (Johnson, Gross, and Moran, in press; Johnson, 1971). The Banner Formation is described in two of the stratigraphic sections in this report, and deposits now assigned to the Banner are described in five of the previously published stratigraphic sections cited in the list of localities following figure 3.

The Banner Formation is predominantly glacial till and coarse outwash, but the molluscan faunas occur in silt and sandy silt units. The Harkness Silt Member occurs below the lowest of the tills and rests directly on the top of the Afton Soil developed in deposits of Nebraskan age. Fossil snails have been collected from the Harkness Silt Member only at the Zion Church Section (Frye, Willman, and Glass, 1964; Willman and Frye, 1970) near the bluff of the Mississippi River Valley in extreme western Illinois. The silt appears to have been deposited in water shortly before the advance of the Kansan glacier into Illinois from the northwest. The shells are sparsely distributed throughout the deposit, and a meaningful fauna was obtained only by bulk sampling and concentration of the shells by washing.

The Banner Formation, above the Harkness Silt Member, consists of interstratified till, outwash, and silts. At some localities the silts contain fossil mollusks. Several of the collections were made from silts that occur below one or more tills of Kansan age, but because the deposit did not rest on the top of the Afton Soil it was not classified as Harkness Silt Member. Notable among such localities are the Long Lake Section (this report) and the Groveland Southwest Section (fig. 3). Here, silts occur immediately above bedrock and are either overlain by till of the Banner Formation (Groveland SW Section) or present the

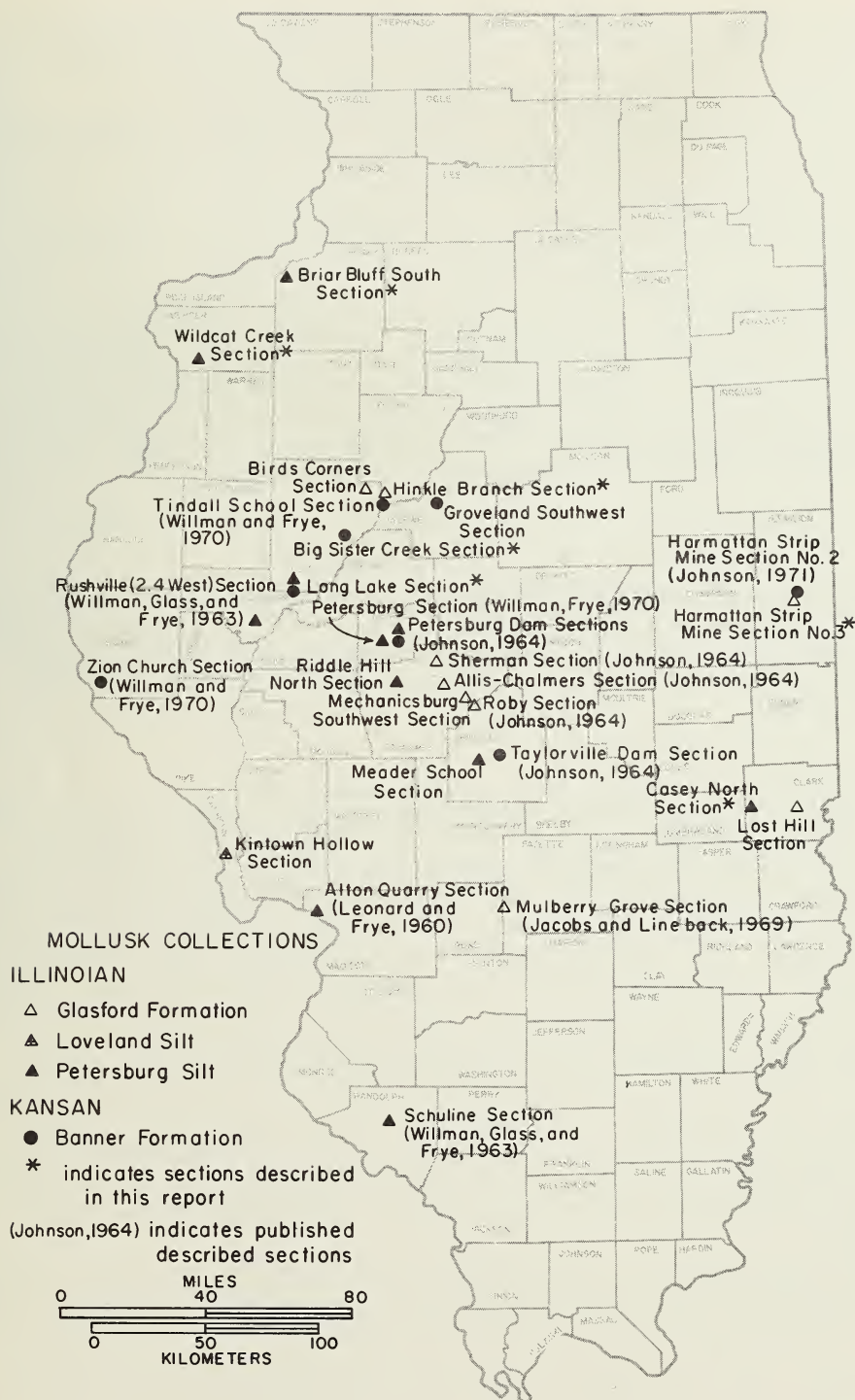


Fig. 1 - Geographic distribution of collecting localities and described stratigraphic sections referred to in this report.

physical appearance of having been incorporated into till at the overriding margin of the glacier (Long Lake Section). Such faunas may be of approximately the same age as the fauna from the Harkness Silt at the Zion Church Section, but the stratigraphic evidence is not clearly indicative of such a conclusion.

Most of the other faunas from the Banner Formation were collected from silt beds that either are interstratified with tills or that occur at such a position that they are presumed to be interstratified with tills of Kansan age. At the Tindall School Section (Willman and Frye, 1970), which is the type section of the Banner Formation, the fauna occurs in fine sand and silt above calcareous till but below a thick sequence of tills and interstratified sand and silt. At the Big Sister Creek Section (this report) the fauna was collected from a silt bed above calcareous till that is classed as part of the Banner Formation. A similar stratigraphic relation occurs at the Taylorville Dam Section (Johnson, 1964), at the Harmattan Strip Mine Section No. 2 (Johnson, 1971), and at the Petersburg Dam Section No. 2 (Johnson, 1964). It is evident that all faunas listed as Kansan in this report occur stratigraphically well below the top of the Banner Formation and in a position that calls for an age assignment older than late Kansan.

Illinoian Stage

The Illinoian Stage has been subdivided into three substages by Willman and Frye (1970): the Liman (oldest), Monican, and Jubileean (youngest). In the following discussions of molluscan faunas, those from the Liman Substage are considered as a unit, but those of the Monican and Jubileean Substages are grouped together.

Liman Substage

The faunas of Liman age described here were all collected from the Petersburg Silt (Willman, Glass, and Frye, 1963; Frye, Willman, and Glass, 1964), which is the lowest formation of Illinoian age over much of western and central Illinois and which also occurs sporadically in the eastern and southern parts of the state. It consists of water-laid silt and in places contains a significant percentage of loess. The Petersburg Silt rests on the Yarmouth Soil or older deposits, is generally a proglacial deposit that was overridden by the advancing earliest Illinoian glacier, and is overlain by the basal tills or coarse outwash of the Glasford Formation. The composition of the silts suggests that initial deposition was the result of local erosion of the pre-existing deposits caused by the climatic change accompanying the advancing Illinoian glacier, but the upper part of the unit reflects the composition of the overlying till and is the result of deposition of proglacial outwash in lakes and the deposition of loess from adjacent outwash-carrying valleys. At some places the overriding glacier incorporated fossiliferous silt into the lowermost few feet of the till (e.g., Petersburg Section, Willman and Frye, 1970).

The Petersburg Silt is terminated by vertical cutoff at the limit of glacial till of Illinoian age. Beyond the glacial limit silts that may be stratigraphically equivalent to the Petersburg are combined with silts stratigraphically equivalent to silts in the Glasford Formation and to the overlying Teneriffe Silt to form the Loveland Silt. Only one molluscan fauna from the Loveland Silt is listed here. Because it was collected from the upper part of the formation, it is placed in the Monican and Jubileean Substages.

Time-Stratigraphic Units			WESTERN ILLINOIS: Rock-Stratigraphic Units				SOUTH-CENTRAL and EASTERN ILLINOIS: Rock-Stratigraphic Units					
SANGAMONIAN STAGE			ILLINOIAN STAGE	GLASFORD FORMATION	Berry Clay Member		TENERIFFE SILT	LOVELAND SILT	GLASFORD FORMATION	Berry Clay Member		LOVELAND SILT
ILLINOIAN STAGE	JUBILEEAN SUBSTAGE				Radnor Till M. Toulon M.					(unnamed till) Roby Silt M.		
	MONICAN SUBSTAGE				Hulick Till M. Duncan Mills M.					Vandalia Till M. Mulberry Grove M.		
	LIMAN SUBSTAGE				Kellerville Till M.					Smithboro Till M.		
			Petersburg Silt			Petersburg Silt						
YARMOUTHIAN STAGE			ILLINOIAN STAGE	BANNER FORMATION	Lierle Clay Member		BANNER FORMATION	Lierle Clay Member				
KANSAN STAGE					(Unnamed tills, intercalated sand and gravel, and silts)			Tilton Till M. Hillery Till M. Harmattan Till M. Belgium M. Hegeler Till M.				
					Harkness Silt M.							

Fig. 2 - Pertinent Illinoian and Kansan rock-stratigraphic units in western, south-central, and eastern Illinois.

In the stratigraphic sections included with this report, the Petersburg Silt is described in the Briar Bluff South, Casey North, Long Lake, and Wildcat Creek Sections. For the remaining seven faunas described from the Petersburg Silt, stratigraphic sections have been published for the Alton Quarry Section (Leonard and Frye, 1960), Petersburg Section (Willman, Glass, and Frye, 1963; Willman and Frye, 1970), Petersburg Dam Section No. 1 (Johnson, 1964), Rushville (2.4W) Section (Willman, Glass, and Frye, 1963), and Schuline Section (Willman, Glass, and Frye, 1963).

Monican and Jubileean Substages

Ten faunal assemblages listed here were collected from deposits of Monican and Jubileean age. Of these, four are from the Roby Silt Member, two from the

[illegible]

[illegible]

* LOCATIONS OF FAUNA LOCALITIES LISTED

- Allis-Chalmers Section: roadcut on Allis-Chalmers testing grounds, SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 29, T. 16 N., R. 3 W., Sangamon County, Illinois. Collected in 1961 (Johnson, 1964).
- Alton Quarry Section: Mississippi Lime Co. quarry, SE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 10, T. 5 N., R. 10 W., Madison County, Illinois. Section studied in 1958, fauna collected in 1970 (Leonard and Frye, 1960).
- Big Sister Creek Section: cutbank of Big Sister Creek, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 8, T. 5 N., R. 4 E., Fulton County, Illinois. Collected in 1962, described section in this report (see also Wanless, 1957, p. 209).
- Birds Corners Section: roadcuts, SW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 4, T. 7 N., R. 5 E., Fulton County, Illinois. Gray, calcareous silts over calcareous Illinoian age till. Collected in 1962.
- Briar Bluff South Section: roadcuts, SW corner of NW $\frac{1}{4}$ Sec. 21, T. 17 N., R. 1 E., Henry County, Illinois. Collected in 1957, described section in this report.
- Casey North Section: Interstate Highway 70 borrow pit, SW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 8, T. 10 N., R. 14 W., Clark County, Illinois. Collected in 1970, described section in this report.
- Groveland Southwest Section: exposure of gray, fossiliferous silt in creek bank below sequence of exposures in adjacent roadcuts, NE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 5, T. 24 N., R. 4 W., Tazewell County, Illinois. Roadcut exposure was Peoria Loess, Roxana Silt, Glasford Formation, and Banner Formation. Collected in 1957.
- Harmattan Strip Mine Section No. 2: exposure in strip mine, SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 34, T. 20 N., R. 12 W., Vermilion County, Illinois. Collected in 1970 (Johnson, 1971).
- Harmattan Strip Mine Section No. 3: strip mine drainage ditch, SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 4, T. 19 N., R. 12 W., Vermilion County, Illinois. Section studied in 1969, fauna collected in 1970, described section in this report.
- Hinkle Branch Section: creek bank, NW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 20, T. 7 N., R. 6 E., Peoria County, Illinois. Collected in 1962, described section in this report.
- Kintown Hollow Section: roadcut, SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 31, T. 10 S., R. 2 W., Calhoun County, Illinois. Collected in 1962 from calcareous silt overlying leached clay, silt, and gravel.
- Long Lake Section: creek bank exposures, center of NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 18, T. 2 N., R. 2 E., Schuyler County, Illinois. Collected in 1962, described section in this report.
- Lost Hill Section: roadcut, NW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 9, T. 10 N., R. 12 W., Clark County, Illinois. Collected in 1970 from gray calcareous silt below calcareous till, leached till, leached silt, sand, and clay and above leached silt (MacClintock, 1929, p. 35).
- Meader School Section: exposure in ditch, SW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T. 12 N., R. 2 W., Christian County, Illinois. Collected in 1961 from calcareous silt below calcareous Illinoian till and above leached clay and silt.
- Mechanicsburg Southwest Section: exposure in creek bank, NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 10, T. 15 N., R. 3 W., Sangamon County, Illinois. Collected in 1961 from calcareous silt below calcareous clay and above calcareous Illinoian till.
- Mulberry Grove Section: borrow pit along Interstate Highway 70, SW $\frac{1}{4}$ Sec. 31, T. 6 N., R. 1 W., Fayette County, Illinois. Collected in 1970 (Jacobs and Lineback, 1969).
- Petersburg Section: roadcut and creek bank, NW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 23, T. 18 N., R. 7 W., Menard County, Illinois. Collected in 1951, 1957, 1962 (Willman, Glass, and Frye, 1963; Willman and Frye, 1970).
- Petersburg Dam Section No. 1: south side of lake, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 26, T. 18 N., R. 6 W., Menard County, Illinois. Collected in 1962 (Johnson, 1964).
- Petersburg Dam Section No. 2: south dam abutment, SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 26, T. 18 N., R. 6 W., Menard County, Illinois. Collected in 1962 (Johnson, 1964).
- Riddle Hill North Section: exposure in roadcut, SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 28, T. 17 N., R. 6 W., Sangamon County, Illinois. Collected in 1961 from calcareous silt below calcareous Illinoian till.
- Roby Section: bank of abandoned meander channel, NW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 14, T. 15 N., R. 3 W., Sangamon County, Illinois. Collected in 1961 (Johnson, 1964).
- Rushville (2.4 W.) Section: roadcut, SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 16, T. 1 N., R. 1 W., Schuyler County, Illinois. Collected in 1959, 1962 (Willman, Glass, and Frye, 1963).
- Schuline Section: roadcut and creek bank, NW $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 24, T. 5 S., R. 7 W., Randolph County, Illinois. Collected in 1970 (Willman, Glass, and Frye, 1963).
- Sherman Section: roadcuts, NE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 19, T. 17 N., R. 4 W., Sangamon County, Illinois. Collected in 1962 (Johnson, 1964).
- Taylorville Dam Section: west end of dam, SE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 36, T. 13 N., R. 2 W., Christian County, Illinois. Collected in 1961 (Johnson, 1964).
- Tindall School Section: borrow pit along north bluff of Illinois River Valley, SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 31, T. 7 N., R. 6 E., Peoria County, Illinois. Collected in 1962 (Frye and Willman, 1958; Willman, Glass, and Frye, 1963; Willman and Frye, 1970).
- Wildcat Creek Section: creek bank, NE $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 9, T. 13 N., R. 4 W., Mercer County, Illinois. Collected in 1962, described section in this report.
- Zion Church Section: roadcuts, SE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 9, T. 3 S., R. 8 W., Adams County, Illinois. Collected in 1963 (Frye, Willman, and Glass, 1964; Willman and Frye, 1970).

Toulon Member, and one from the Mulberry Grove Member of the Glasford Formation. Two collections are from undifferentiated deposits of the Glasford Formation, and one is from the upper part of the Loveland Silt. In all cases the fossils occurred in slack-water silts or in silt and fine sand. With the exception of the collection from the Loveland Silt at the Kintown Hollow Section (fig. 3) (and possibly also from the Birds Corners Section [fig. 3], where the stratigraphic relations are not fully clear), all of these faunas were collected from deposits occurring between tills or between tills and coarse outwash.

In the stratigraphic sections included with this report, the Toulon Member of the Glasford Formation is described in the Hinkle Branch Section, and the undifferentiated Glasford Formation is described in the Harmattan Strip Mine Section No. 3. Of the remaining localities, the Roby Silt Member of the Glasford Formation is described in the Allis-Chalmers, Roby, and Sherman Sections by Johnson (1964), and the Mulberry Grove Member of the Glasford Formation is described in the Mulberry Grove Section by Jacobs and Lineback (1969).

FOSSIL MOLLUSCAN FAUNAS

The molluscan faunas reported here were collected for the most part by bulk sampling, although specimens exposed on the surface were collected individually. Bulk samples generally consisted of fifty to one hundred pounds or more of matrix containing shells. Samples were dried and then washed over screens of appropriate mesh, a procedure which resulted in the recovery of most of the shells together with roots, coarse matrix, and other detritus. The concentrate was then dried, and the shells were sorted from the mixture, after which they were boiled briefly in water containing a non-foaming detergent. This procedure cleaned the shells, including their apertures, which are especially important in pupillid shells, which cannot be identified without reference to the apertural denticles. Following the cleaning process, the shells were finally dried and sorted to species.

Such collecting techniques produce maximum numbers of individuals, but even then the collection may not accurately represent the faunal complex as it was at the time the sediments were being deposited. Several factors tend to skew the results: namely, the size of the sample taken; the nature and areal extent of the exposure of fossiliferous sediments; the facies exposed and available for study; the lack of useful exposures in some critical areas; relative fragility, shape, and size of shells of different species of mollusks, each of which importantly influences their transport, deposition, and preservation; and others. Faunal collections made within a few feet of each other have been shown to vary considerably.

In spite of these variables, however, a significant consistency among assemblages of shells exists where many collections are made at the same, or nearly the same, stratigraphic level.

It is remarkable, considering the relatively large number of bulk samples studied, that virtually no vertebrate remains were found, although the methods used are equally applicable to the collection of the teeth and bones of small vertebrates. Except for a few isolated teeth of small rodents, no vertebrate fossils of any kind have been encountered in these studies. The reasons for their absence remain obscure, since small vertebrate animals must have coexisted with the molluscan faunas represented by the shells herein reported.

Stratigraphic Paleontology

Although deposits of clearly demonstrated Nebraskan age are known in Illinois, no fossiliferous Nebraskan deposits have been found. Fossiliferous deposits of Kansan age are rare in Illinois, but the eight localities from which collections were made span more than 200 miles east-west across the central part of the state (fig. 1). Molluscan faunas of Illinoian age are widely distributed throughout the central half of the state.

Kansan Molluscan Faunas

Kansan molluscan species and their stratigraphic and areal distribution are shown in figures 3 and 4. Several distinctive features of the Kansan faunal assemblages are worthy of comment.

One distinctive feature is the preponderance of terrestrial species, despite the fact that the exposures sampled consist of fluvial and lacustrine deposits. Among the 47 kinds of mollusks here reported from Kansan sediments, 40 are terrestrial and only seven are aquatic in habit. Furthermore, among the seven aquatic species, two of them, Gyraulus parvus and Lymnaea humilis, occur at only one locality each. Lymnaea dalli, Valvata sincera, and V. tricarinata each occur at five of the localities, Gyraulus altissimus, is found at four localities, and an unidentified species of Pisidium occurs at two locations. These aquatic mollusks, all associated with lacustrine habitats, must have lived with fishes and amphibians, but for unknown reasons no fossils of these vertebrates were observed. It is equally difficult to explain the absence from the aquatic phase of the assemblages of Helisoma antrosa and H. trivolvis, which are common pond snails in Wisconsinan deposits, and the several species of Amnicola that are at least locally abundant in Wisconsinan sediments in Illinois (Leonard and Frye, 1960).

Among the terrestrial snails, the majority indicate a forest habitat or a forest-border environment. Such species as Cionella lubrica, Columella alticola, Euconulus fulvus, Haplotrema concavum, Mesodon clausus, Stenotrema monodon, S. hirsutum, S. stenotrema, Striatura milium, and Strobilops labyrinthica are typical of mixed hardwood forests, although they may occasionally occur in forest-border situations. On the other hand, the assemblage lacks many species that should be expected to occur with them if deductions concerning the probable habitat are correct: for example, Anquisma kochi, Polygyra profunda, Triodopsis albolabris, and the several possible species of Mesomphix, Ventridens, and other genera from woodland habitats. The remaining terrestrial species are less restricted to woodland situations but vary among themselves as to moisture and other requirements.

There is little to be learned from the fauna as far as temperature tolerance is concerned, except that there are no southern faunal elements. The only possible northern element may be Vertigo occulta, which is not recorded among the present living pupillid fauna but seems to be closely related to Vertigo nylanderi, an inhabitant of northern Maine and southern Canada. In less precise fashion, the assemblage of terrestrial mollusks reflects a somewhat more northern latitude, such as that of Michigan. For example, Carychium canadense, a widely distributed and locally abundant species in both Kansan and Illinoian deposits, today inhabits the northern tier of states and southern Canada east of the Rockies and occurs on Vancouver Island. In summary, the Kansan faunal assemblage in Illinois indicates,

<div> <div></div> <div>RANGE</div> <div>MOLLUSCAN SPECIES</div> </div>	WISCONSINAN STAGE		ILLINOIAN STAGE		KANSAN STAGE
	WOODFORDIAN SUBSTAGE	FARMDALIAN AND ALTONIAN SUBSTAGES	JUBILEEAN AND MONICAN SUBSTAGES	LIMAN SUBSTAGE	
<i>Gastrocopta holzingeri</i>					
<i>Gastrocopta procera</i>					
<i>Helisoma trivolvis</i>					
<i>Planorbula armigera</i>					
<i>Pupoides albilabris</i>					
<i>Sphaerium occidentale</i>					
<i>Stenotrema leai</i>					
<i>Triodopsis algonquinensis</i>					
<i>Triodopsis fosteri</i>					
<i>Vertigo milium</i>					
<i>Helisoma antrosa</i>					
<i>Mesodon thyroidus</i>					
<i>Pisidium caseratanum</i>					
<i>Pisidium nitidum</i>					
<i>Pisidium variabile</i>					
<i>Sphaerium striatinum</i>					
<i>Stenotrema fraternum</i>					
<i>Vallonia parvula</i>					
<i>Allogona profunda</i>					
<i>Amnicola leightoni</i>					
<i>Amnicola lustrica</i>					
<i>Anguispira kochi</i>					
<i>Triodopsis altonensis</i>					
<i>Triodopsis hubrichti</i>					
<i>Aplexa hypnorum</i>					
<i>Lymnaea exilis</i>					
<i>Acella haldermani</i>					
<i>Succinea avara</i>					
<i>Vertigo briarensis</i>					
<i>Armiger exigua</i>					
<i>Deroceras aenigma</i>					
<i>Helicodiscus singleyanus</i>					
<i>Lymnaea palustris</i>					
<i>Gastrocopta armifera</i>					
<i>Gastrocopta contracta</i>					
<i>Lymnaea obrussa decampi</i>					
<i>Pisidium compressum</i>					
<i>Pomatiopsis scalaris</i>					
<i>Punctum minutissimum</i>					

Fig. 4 - Range of Pleistocene

<i>Succinea grosvenori</i>						
<i>Triodopsis multilineata</i>						
<i>Anguispira alternata</i>						
<i>Carychium canadense</i>						
<i>Cionella lubrica</i>						
<i>Columella alticola</i>						
<i>Discus cronkhitei</i>						
<i>Discus macclintocki</i>						
<i>Euconulus fulvus</i>						
<i>Gastrocopta pentodon</i>						
<i>Gyraulus altissimus</i>						
<i>Gyraulus parvus</i>						
<i>Haplotrema concavum</i>						
<i>Hawaiiia minuscula</i>						
<i>Helicodiscus parallelus</i>						
<i>Hendersonia occulta</i>						
<i>Lymnaea dalli</i>						
<i>Lymnaea parva</i>						
<i>Mesodon clausus</i>						
<i>Pupilla muscorum</i>						
<i>Retinella electrina</i>						
<i>Stenotrema hirsutum</i>						
<i>Strobilops labyrinthica</i>						
<i>Succinea gelida</i>						
<i>Succinea ovalis</i>						
<i>Vallonia gracilicosta</i>						
<i>Valvata tricarinata</i>						
<i>Vertigo alpestris oughtoni</i>						
<i>Vertigo hubrichti</i>						
<i>Vertigo modesta</i>						
<i>Zonitoides arboreus</i>						
<i>Valvata sincera</i>						
<i>Gastrocopta venusta</i>						
<i>Stenotrema monodon</i>						
<i>Striatura milium</i>						
<i>Strobilops affinis</i>						
<i>Succinea exile</i>						
<i>Vertigo elatior</i>						
<i>Vertigo hannai</i>						
<i>Vertigo morsei</i>						
<i>Punctum parvula</i>						
<i>Stenotrema stenotrema</i>						
<i>Vertigo occulta</i>						
<i>Deroceras cf. laeve</i>						
<i>Lymnaea humilis</i>						
<i>Vallonia albula</i>						
<i>Vertigo tridentata</i>						
Total species	86	56	54	52	56	45

so far as can be determined, a north-temperate climate and apparently a partially wooded terrain having open savannas interspersed with woodland but not deep forest cover.

The Kansan assemblage reported here contains several gastropods not previously known; these include Gastrocopta venusta, Punctum parvula, Succinea exile, and Vertigo occulta (Leonard, 1971). None of these four species that make their first appearance in the Kansan are restricted to it; all extend upward into the immediately overlying Petersburg Silt (Liman Substage of the Illinoian Stage), and one of them, Gastrocopta venusta, extends into the overlying Glasford Formation.

Only four species in the Kansan assemblage are restricted to it: Deroceras cf. laeve, Lymnaea humilis, Vallonia albula, and Vertigo tridentata (fig. 4). Although seemingly restricted to the Kansan in Illinois, all occur in Wisconsinan and Holocene faunas elsewhere in North America. Three of the four species occur only in the Belgium Member of the Banner Formation at a locality in extreme eastern Illinois. The fourth species likewise occurs in only one locality. The geographic limitation of these four seems likely to be an accident of collecting. Certainly, the large assemblage of restricted molluscan species that characterize the Kansan deposits in the Great Plains does not occur in Illinois. This contrast is judged to be the result of the different climatic histories of the two regions. Although the Kansan climate of the central Great Plains was similar to the climates in Illinois that immediately preceded and followed the episodes of glacial advance and retreat, the climate of the Great Plains was much more inhospitable during interglacial episodes. The present climate of Illinois is not strikingly different from that which existed in the area during parts of Kansan time when glaciers were not present in the state. The result of these relatively similar climates on the snail faunas is that Kansan molluscan faunas cannot be differentiated from Illinoian faunas in the field and can be recognized only with great difficulty in the laboratory.

Illinoian Molluscan Faunas

The known Illinoian molluscan assemblage in Illinois, listed by geographic location and stratigraphic position, is shown in figure 3. Of a total of 61 species, 18 are not known from deposits younger than the Illinoian although 11 of these range downward into the Kansan. Only seven species are seemingly restricted to the Illinoian, and of these, only one, Vertigo briarensis, seems to be generally characteristic of Illinoian age deposits. This species occurs in ten of the 21 Illinoian localities studied and commonly in considerable abundance. It is related to Vertigo occulta, which extends from the Kansan into the Petersburg Silt, the basal Illinoian deposit. Among the remainder of the seven species, Acella haldermani and Succinea avara occur in two localities and the remaining four species, including Armiger exigua, Deroceras aenigma, Helicodiscus singleyanus, and Lymnaea exilis, are limited to a single locality. Thus their occurrences bear little significance in the interpretation of faunal assemblages, and their presence or absence must be regarded as accidents to be expected in random sampling. Among the Illinoian assemblage 40 species range upward into deposits of Wisconsinan age, but the published Wisconsinan fossil molluscan fauna of Illinois (Leonard and Frye, 1960) includes 24 species that have not so far been found in Illinoian or older deposits (fig. 4).

A great number of the 65 species composing the combined Kansan and Illinoian molluscan assemblage occur abundantly in sediments of both ages. Among these, the following should be mentioned: Carychium canadense, Cionella lubrica, Columella alticola, Discus cronkhitei, D. macclintocki, Euconulus fulvus, Gastrocopta pentodon, Gyraulus altissimus, Hendersonia occulta, Lymnaea dalli, L. parva, Punctum parvula, Pupilla muscorum, Retinella electrina, Stenotrema monodon, Strobilops labyrinthica, Succinea gelida, Vallonia gracilicosta, Valvata sincera, V. tricarinata, Vertigo elatior, Vertigo modesta, V. occulta, and perhaps a few others that occur in both faunas if not in as many localities as those mentioned. These species, indicating the lacustrine, woodland, and woodland-border types of environments, probably reflect most accurately the local environments at the time of deposition of the sediments.

From these populations it can be deduced that the broad aspects of the environment in the parts of Illinois represented by these collections differed little between Kansan and Illinoian times and that adaptive radiation was active in only a few genera.

Comparison with Great Plains Faunas

In studies made of fossil molluscan assemblages from deposits of Kansan and Illinoian age in the Great Plains (Leonard, 1950; 1952), a total of 65 species collected from 20 localities made up the composite fauna associated with the Pearlette volcanic ash. Although the published work (Leonard, 1950) referred the deposits to the Yarmouthian Stage, the deposits were subsequently placed in the Kansan Stage and considered to be late Kansan in age (Frye and Leonard, 1952); they clearly occur below the Yarmouth Soil. Among these faunas, some 13 species, or 20 percent of the total fauna known from the central Great Plains, belong to kinds restricted to Kansan sediments, and an additional three species, known from Nebraskan deposits, are not known to range above the Kansan. Thus, in effect, 16 species among a total of 65, or approximately 25 percent, are restricted to the Kansan, while in Illinois for practical utility in the field there are no restricted species. In 1952 Leonard made a comparative study of Kansan, Illinoian, and Wisconsinan molluscan faunas in the Great Plains. This study showed that among 74 species known from the Kansan through late Wisconsinan (Bignell Loess), 30 are restricted as fossils to the Sappa Silt of late Kansan age, although this figure includes a few species that are living today. A relatively small number of the species found in deposits of Kansan age are known to extend upward through the Illinoian Stage, but not into deposits of Wisconsinan age. This faunal succession in the central Great Plains presents a strong contrast to the faunal succession in Illinois, where the great majority of the Kansan species extend into deposits of Illinoian age or younger.

Such comparisons are, of course, complicated by differences in environment and in sedimentary facies. For example, comparison of faunal assemblages from fluvial or lacustrine deposits with those from eolian sediments may be quite misleading, because the environments are, at least in certain aspects, mutually exclusive. On the other hand, the elimination of a species from deposits of a certain age is for that stratigraphic unit truly an extinction, even though the species is living elsewhere. For example, in the Great Plains, Valvata tricarinata is a common species in Kansan deposits but is not known to occur in later sediments, although the species is living today elsewhere. Nevertheless, Valvata is an "index fossil" for the Kansan in the Great Plains. On the other hand, Heli-

soma antrosa (anceps) occurs in Kansan and Illinoian deposits in the Great Plains but is not known from Wisconsin fossiliferous sediments, partly, at least, because the latter are almost everywhere composed of eolian loess. The species is known to have occurred in the eastern part of the Plains Border Province until very recent time. A meaningful comparison therefore must be made between faunas from similar sedimentary environments. One cannot directly relate fossil assemblages from upland eolian sediments with those from fluvial and lacustrine deposits.

In the Great Plains the evidence is clear that major, and perhaps catastrophic, oscillations of climate so critically changed the required environmental conditions for mollusks that each large segment of time is marked by an assemblage that is uniquely characteristic of that particular interval. It seems probable that these pulsating faunal restrictions were occasioned by the fact that the climate was near the threshold conditions for many species and when it fluctuated past a critical point many of them were eliminated from the region (Frye and Leonard, 1967) and reinvasions produced different assemblages. These oscillations of environment in the Great Plains, through the several rhythmic oscillations in Pleistocene history from the Nebraskan to the present, resulted in the reduction of the molluscan fauna to the depauperate assemblage that now lives there. In the Bignell Loess, we have essentially the Holocene faunal assemblage.

Not so in Illinois. Pre-Kansan faunas are not known, but from the Kansan to the present, no consistent change in the character of molluscan faunal assemblages is discernible. To be sure, there are modifications. A few species came and went but basically the molluscan faunas re-established themselves after each stage of extirpation by the Pleistocene glaciers. The changes in molluscan faunas within the span of the Wisconsinan in Illinois (Leonard and Frye, 1960) are as great as any that occur within the major oscillations of Pleistocene environments, and it would seem evident that the climatic changes implied between the Altonian-Farmdalian and Woodfordian Substages reported in figure 4 represent environmental cataclysms as striking as those that characterize the contrast between the Kansan and Illinoian episodes.

Molluscan faunas on the Great Plains during Kansan time were not unlike those in Illinois at that time. The Great Plains fauna gradually evolved toward that of the Holocene, largely by the slow but inexorable process of extinction. Essentially, Illinois has retained its Kansan molluscan fauna up to the present day. True, there are mollusks living in Illinois that are not known from the Pleistocene, but these are relatively few and do not serve to change the general aspect of the fauna.

The remarkable feature of the molluscan faunas from the Pleistocene of Illinois is their incredible ability to invade and repopulate terrain from which they had been driven by advancing glaciers with so little admixture of "foreign" populations. The magnitude of the emigration and immigration routes must have involved more than three hundred miles. It has been pointed out that mollusks characteristic of these faunas were at times living very close to the margin of the glacier (Frye and Willman, 1958; Leonard and Frye, 1960). We conclude that the molluscan populations moved in and out with the sweeps of glaciation and changed remarkably little over a very long interval of time.

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STRATIGRAPHIC SECTIONS

Following are seven described stratigraphic sections, from which eight of the fauna collections listed here were obtained. The lithologic sample numbers, preceded by P-, refer to samples in the collections of the Illinois State Geological Survey, and mineral analyses of most of these samples are on file. The stratigraphic sections are arranged alphabetically by name. Fourteen additional described stratigraphic sections that have been published previously are referred to in this report. They are listed with citations following the chart of fauna localities in figure 3. Geographic locations of all described stratigraphic sections and fauna localities used in this report are shown on figure 1.

BIG SISTER CREEK STRATIGRAPHIC SECTION

Measured in cutbank of Big Sister Creek, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 8, T. 5 N., R. 4 E., Fulton County, Illinois (sampled 1962). (See also Wanless, 1957, p. 209.)

PLEISTOCENE SERIES

Thickness
(feet)

ILLINOIAN STAGE

Glasford Formation (undifferentiated)

- | | | |
|-----|--|-----|
| 15. | Modern Soil, gray-brown, leached, friable. | 1.0 |
| 14. | Till, leached, brownish gray with dark brown on ped surfaces; sparse pebbles; Sangamon Soil. | 8.0 |
| 13. | Till, rusty brown, leached in upper part to calcareous in lower; gray in center of joint blocks. | 1.7 |
| 12. | Till, calcareous, gray. | 7.0 |
| 11. | Sand, calcareous, reddish to yellowish. | 1.5 |
| 10. | Silt and sand, calcareous, blue-gray. | 1.4 |

Petersburg Silt

- | | | |
|----|--|-----|
| 9. | Clay and silt, calcareous, dark bluish gray; contains carbonaceous material and wood fragments. | 1.5 |
| 8. | Silt, calcareous, slightly fossiliferous, gray to brownish gray; some wood fragments and carbonaceous flecks. | 1.7 |
| 7. | Sand, slightly calcareous, yellowish to reddish brown; fine grained in upper part to coarse grained in lower part. | 6.0 |

KANSAN STAGE

Banner Formation

- | | | |
|----|---|----------|
| 6. | Gravel, leached, oxidized to yellow-brown to reddish brown; contains Mn-Fe streaks and pellets; truncated Yarmouth Soil, lacking a well defined B-zone. | 2 to 4.0 |
| 5. | Silt, calcareous, massive, gray; some plant stems and very few shell fragments in upper part (sample P-1368x); middle part laminated dark gray and light gray with abundant but partly crushed gastropod shells; lower part massive and resembling the uppermost part of the bed. | 3.5 |
| 4. | Sand, calcareous, tan, massive. | 0.7 |
| 3. | Silt, clayey, calcareous, gray, massive. | 0.8 |
| 2. | Sand, calcareous, reddish, grading downward into gravel, partly cemented; uneven lower contact. | 5.0 |

	Thickness (feet)
1. Till, calcareous, dark blue-gray, bouldery; to level of creek channel.	<u>5.0</u>
Total	46.8

BRIAR BLUFF SOUTH STRATIGRAPHIC SECTION

Measured in roadcuts, SW cor., NW $\frac{1}{4}$ Sec. 21, T. 17 N., R. 1 E., Henry County, Illinois (1957).

PLEISTOCENE SERIES	Thickness (feet)
WISCONSINAN STAGE	
WOODFORDIAN SUBSTAGE	
Peoria Loess	
8. Loess, massive, leached, yellow-tan to light brown; Modern Soil in top.	9.0
7. Loess, massive, calcareous, yellow-brown, friable, some CaCO ₃ concretions; lower 5 feet mottled with gray and contains abundant fossil snails (Leonard and Frye, 1960).	12.5
6. Loess, gray, compact, calcareous; weakly calcareous in lowermost 1/2 foot; brown mottling and a few limonite concretions; sparsely fossiliferous.	2.0
FARMDALIAN SUBSTAGE	
Robein Silt	
5. Silt, gray, locally calcareous; contains zones of dark humic silt that have been distorted by cryoturbations.	2.0
ILLINOIAN STAGE	
LIMAN SUBSTAGE	
Glasford Formation	
Kellerville Till Member	
4. Till, clayey, rusty red-brown, compact, leached; B-zone of Sangamon Soil.	4.0
3. Till, tan and gray, leached, massive, compact.	2.5
2. Till, calcareous, gray; streaks and spots of light brown.	6.5
Petersburg Silt	
1. Silt, massive, calcareous, gray and tan conformable with till above; locally contains limonite laminae; contains fossil snails.	<u>3.0</u>
Total	41.5

CASEY NORTH STRATIGRAPHIC SECTION

Measured in borrow pit on north side of Interstate Highway 70, SW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 8, T. 10 N., R. 14 W., Clark County, Illinois (1970).

PLEISTOCENE SERIES

SANGAMONIAN STAGE

Thickness
(feet)

Glasford Formation

Berry Clay Member

8. Accretion-gley; Sangamon Soil; sand and clay with some silt and dispersed small pebbles, leached, dark gray mottled with dove gray and streaked with light brown, massive (P-7170 from mid part); top of this interval is several feet below the original land surface because of excavation work. 7.0

ILLINOIAN STAGE

Glasford Formation (undifferentiated)

7. Till, leached, oxidized, rusty brown, sandy silty to sandy, pebbly but lacking cobbles and boulders (P-7169). 1.5
6. Till, calcareous, compact, jointed, contains cobbles and boulders, gray, gray-brown and lavender-gray, massive, silty sandy to sandy silty; upper part oxidized along joints (P-7168 upper; P-7167 middle; P-7166 lower). 14.0
5. Sand and silt with some clay, calcareous, gray and tan (P-7165); sand and gravel lenses up to 5 feet thick occur laterally along the cut at this position. 1.5
4. Sand and silt, oxidized, loosely cemented with limonite, weakly calcareous to calcareous, rusty brown to reddish brown (P-7164); irregular to crenulate with irregular boundaries and thickness. 1.5
3. Till, calcareous, dense, compact, tough, pebbly and cobbly, massive and jointed, gray to gray-tan (P-7163 upper; P-7162 lower). 7.0
2. Till, consists of 50 percent silt with small stems and wood fragments and fossil snail shells, calcareous, contorted, compact, gray streaked with tan (P-7161); contains pebbles but few cobbles. 4.0

Petersburg Silt

1. Silt, with some clay and fine sand, calcareous, gray becoming dark gray to black downward, compact; contains twigs, stems and other wood fragments and fossil snail shells, all becoming more abundant downward; locally contorted; upper part contains a few dispersed pebbles and the contact with the overlying till is not distinct because of incorporation of similar silt in basal part of till (P-7160 upper; P-7159 lower); to water level in borrow pit. 5.0

Total 41.5

HARMATTAN STRIP MINE STRATIGRAPHIC SECTION NO. 3

Measured in mine drainage ditch, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 4, T. 19 N., R. 12 W., Vermilion County, Illinois (1969, 1970).

PLEISTOCENE SERIES		Thickness
WISCONSINAN STAGE		(feet)
WOODFORDIAN SUBSTAGE		
Richland Loess		
8.	Loess, leached, tan-brown; Modern Soil. Henry Formation Batavia Member	4.0
7.	Sand, gravelly, yellow-brown to dark brown; leached and clay-enriched in upper part; calcareous at base; thickness and character vary laterally. Wedron Formation Batestown Till Member	5.0
6.	Till, light olive brown to gray, calcareous, small blocky structure, shale pebbles common; interbedded outwash and silt in upper portion; thin zones of pinkish till near base; (P- 10175 upper to P-10178 lower).	6.0
ILLINOIAN STAGE		
JUBILEEAN SUBSTAGE		
Glasford Formation (undifferentiated)		
5.	Till, gray, calcareous, sandy; locally a thin light gray silt or a boulder pavement striated N 20° E at upper contact; (P-10179 upper and P-10180 lower).	3.0
4.	Till, brown to gray-brown, calcareous, silty, contains many wood fragments and fossil fragments; (P-10181 upper and P- 10182 lower).	2.0
3.	Silt, calcareous, upper 3 inches grayish white, next 3 inches quite carbonaceous and dark brown, next 2 inches rusty brown, lower 2 feet dark gray-brown to gray; laminated; upper portion contains many wood fragments and is fossiliferous, particularly where not so carbonaceous. Radiocarbon date of wood from upper 6 inches >47,000 radiocarbon years B.P. (ISGS 29). (P- 10186 upper to P-10192 lower).	2.7
MONICAN SUBSTAGE		
Glasford Formation (continued)		
2.	Sand, gravelly, yellow-brown to gray-brown, calcareous; lower portion contains interbedded till; (P-10183 lower). Vandalia Till Member	4.5
1.	Till, brown to grayish brown, calcareous, sandy, hard; base not exposed; (P-10184 upper and P-10185 lower).	<u>3.0</u>
Total		30.2

HINKLE BRANCH STRATIGRAPHIC SECTION

Measured in creek bank, NW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 20, T. 7 N., R. 6 E.,
Peoria County, Illinois (1962).

PLEISTOCENE SERIES		Thickness
WISCONSINAN STAGE		(feet)
WOODFORDIAN SUBSTAGE		
Peoria Loess		
5.	Loess, leached, tan-brown; Modern Soil.	4.0
SANGAMONIAN STAGE		
Glasford Formation		
Berry Clay Member		
4.	Accretion-gley; Sangamon Soil.	3.0
ILLINOIAN STAGE		
JUBILEEAN SUBSTAGE		
Glasford Formation (continued)		
Radnor Till Member		
3.	Till, tan-brown to gray; leached in upper part; calcareous in lower part, cobbly, massive.	10.0
Toulon Member		
2.	Silt, coarse, laminated, tan; sparsely fossiliferous; grading downward into sand with some gravel at base.	8.0
MONICAN SUBSTAGE		
Glasford Formation (continued)		
Hulick Till Member		
1.	Till, calcareous, massive, tan and gray.	<u>40.0</u>
Total		65.0

LONG LAKE STRATIGRAPHIC SECTION

Measured in several creek bank exposures, center of NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 18, T. 2 N., R. 2 E., Schuyler County, Illinois (1962).

PLEISTOCENE SERIES		Thickness
ILLINOIAN STAGE		(feet)
Glasford Formation (undifferentiated)		
7.	Sand, grading downward into sand and gravel, leached, red-brown to tan-brown; strongly developed Sangamon Soil in top.	14.0
6.	Till, calcareous, massive, tan to gray.	10.0
5.	Till, calcareous, gray; contains blocks of calcareous fossiliferous silt from below; silt composes more than half of the deposit.	3.0
Petersburg Silt		
4.	Silt, clayey, calcareous, gray and tan; contains fossil gastropods; caliche nodules occur in distinct bands; sharp contacts at top and bottom.	5.0
KANSAN STAGE		
Banner Formation		
3.	Silt, sandy, clayey, leached, dark gray, tough, massive; this unit is part of the Yarmouth Soil, but a well defined B-zone was not recognized.	4.0
2.	Silt, clayey, sandy, leached, gray-green, tough, massive; sharp contacts at top and bottom.	3.0

	Thickness (feet)
1. Silt, sandy silt, and clayey silt, calcareous; contorted bands of gray, tan, and rusty brown; highly fossiliferous in local areas but lacking fossils in other areas (P-1369x); contains irregular blocks of Pennsylvanian rocks up to 2 feet in diameter; bedded silts that have been plowed up and distorted by a glacier but lack normal characteristics of glacial till; rests directly on bedrock.	<u>6.0</u>
Total	45.0

WILDCAT CREEK STRATIGRAPHIC SECTION

Measured in creek bank, NE $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 9, T. 13 N., R. 4 W., Mercer County, Illinois (1962).

PLEISTOCENE SERIES	Thickness (feet)
ILLINOIAN STAGE	
LIMAN SUBSTAGE	
Glasford Formation	
Kellerville Till Member	
4. Till, calcareous, gray.	30.0
3. Gravel and sand, calcareous.	2.0
Petersburg Silt	
2. Silt and fine sand, calcareous, laminated, gray with some tan.	4.0
1. Silt, calcareous, massive, dark gray with some tan, humus streaks; contains fossil snails in mid part; to level of creek.	<u>14.0</u>
Total	50.0

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